



Machine Reasoning

Course Manager: GU Zhan (Sam)
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Course Manager/Lecturer



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Mr. GU Zhan 顾瞻 (Sam) lectures Master of Technology programme in the areas of data science, machine intelligence, and soft computing. Prior to joining ISS, he was in New Zealand running start-up, delivering artificial intelligence training programs. Sam had also spent many years in financial and engineering sector wearing versatile hats: data scientist, project manager, consultant, system manager and software engineer.

Learning Outcomes

1. **Identify** needs of machine reasoning technology in various industrial applications.
2. **Acquire** knowledge of core machine reasoning techniques, including rule-based logical reasoning, domain expert's knowledge representation and acquisition, knowledge discovery, and handling uncertainty during reasoning process
3. **Apply** machine learning technique to extract industrial domain knowledge and express business rules in computer readable format.
4. **Compare** the architectures and main techniques used in versatile reasoning systems.
5. **Design** knowledge based machine reasoning software modules based on expected business outcomes and industrial domain knowledge
6. **Architect** software application by applying learnt machine reasoning techniques and graphical system development.

Agenda

Day 1

- 1.1 Machine Reasoning Overview
- 1.2 Reasoning System Architectures
- 1.3 Rule/Process Reasoning System **Workshop**

Day 3

- 3.1 Deductive Reasoning by Logical Inference
- 3.2 Reasoning under Uncertainty
- 3.3 Deductive Reasoning (under Uncertainty) **Workshop**

Day 2

- 2.1 Machine Reasoning Enabler: Knowledge Representation
- 2.2 Machine Reasoning Enabler: Knowledge Acquisition
- 2.3 Knowledge Representation and Acquisition/Discovery **Workshop**

Day 4

- 4.1 Knowledge Discovery by Machine Learning (Big Data)
- 4.2 Contemporary Reasoning Systems (Big Data)
- 4.3 Building Machine Reasoning System **Workshop**

Agenda : Course Assessment & Grading

MTech Thru-Train

- **In-Class Assessments [Individual]** due within one week after 4th class
 - 60 minutes open book test (course level)
- **In-Class Workshops [Individual]** due within one week after 4th class
- **Project Work [Group]**
 - Refer to Practice Module if applicable.

Agenda : Course Assessment & Grading

In-Class Assessments

Graduate Certificate: page 1 of 13

Name	:
Email	:
Phone No.	:
NUS Matriculation No. (If applicable)	:

Institute of Systems Science
National University of Singapore

**GRADUATE CERTIFICATE
INTELLIGENT REASONING SYSTEMS**

Assessment

Subject: _____

SECTION A



Question	Marks
1	/20
2	/30
TOTAL	/50

Instructions for Paper

Date: Monday 21 Jan 2019
Time: 10.50 a.m.
Duration: One hour (11.00 a.m. to 12.00 p.m.)
Place: ISS premise

This is an OPEN BOOK examination. This examination paper consists of one Section and two Questions. You are to answer ALL questions. There are a total of 50 Marks for this paper.

Version 2018 09 19



- Open book individual test
- Digitized assessment paper: Microsoft Word document .docx
- Internet (re)search is allowed but no online discussion, e.g. WhatsApp, Internet Messaging, Email, etc.
- Bring your IC identification card.

Agenda : Course Assessment & Grading

In-Class Workshops

[In-Class Workshops Submission]

- Deliverables in a single zip file for an example reasoning system enhanced by knowledge discovery technique, e.g. mortgage approval
- Naming convention:
 1. A zip file for day 4 (individual): *ID_FullName_DayX.zip* e.g. *A1234567B_Gu Zhan_Day1.zip*
- Upload to NUS (Canvas) respective submission folders.

[Your actions before 1st course]

Personal computer setup & Software installation list

Computer setup & Software list		Reference
* Install inside your operating system:		
VirtualBox		https://www.virtualbox.org/wiki/Downloads
VirtualBox Extension Pack		https://download.virtualbox.org/virtualbox/6.1.16/Oracle_VM_VirtualBox_Extension_Pack-6.1.16.vbox-extpack
* Install inside Virtual box:		
Linux Ubuntu (Desktop) 20.04 LTS		https://ubuntu.com/download/desktop
Guide: Install Ubuntu on Oracle VirtualBox		https://www.c-sharpcorner.com/article/how-to-install-ubuntu-on-windows-10-using-virtualbox/
* Install inside Ubuntu:		
Anaconda (Python)		https://www.anaconda.com/products/individual
Docker	Optional	https://www.digitalocean.com/community/tutorials/how-to-install-and-use-docker-on-ubuntu-20-04
SQLite (Database)		https://linuxhint.com/install_sqlite_browser_ubuntu/
SQLite Browser		same as above (or research via search engine)
R (CRAN statics tool)	Optional	https://linuxize.com/post/how-to-install-r-on-ubuntu-20-04/
RStudio Desktop (IDE for R) Ubuntu 18/Debian 10 rstudio-1.3.1093-amd64.deb	Optional	https://rstudio.com/products/rstudio/download/#download
* Apply for account:		
GitHub	Optional	https://github.com/

[Recommended references]

Homework (no submission)

Homework Topic	Priority	Example Tools	Reference
From Human Intelligence to Machine Intelligence	1		https://youtu.be/HQUxSi52Ujk
Computer Programming	2	Python Anaconda	https://www.anaconda.com/
Machine Memory: Database & SQL	3	SQLite; MySQL	https://github.com/agarcialeon/awesome-database
Text Processing	4	Python lib: SpaCy	https://github.com/keon/awesome-nlp
Optimization	5	Google OR-Tools; KIE-OptaPlanner	https://developers.google.com/optimization
Cloud Computing	6	GCP; AWS	https://github.com/tmrts/awesome-cloud-computing
Machine Reasoning	7	Semantic Reasoner; KIE-Drools; KIE-jBPM;	https://github.com/semantalytics/awesome-semantic-web
Speech Virtual Assistant	8	Mycroft; RASA;	https://mycroft.ai/
Information Retrieval / Search Engine	9	Chatter-Bot; Lucene; Lemur;	https://github.com/harpribot/awesome-information-retrieval
Knowledge Graph & GraphDB	10	protégé; grakn.ai	https://github.com/totogo/awesome-knowledge-graph
Recommender	11		https://github.com/jihoo-kim/awesome-RecSys
Big Data	12	Spark; Hadoop;	https://github.com/onurakpolat/awesome-bigdata
Machine Learning	13	Scikit-Learn; Orange3	https://github.com/josephmisiti/awesome-machine-learning
Object/Face Detection	14		https://github.com/amusi/awesome-object-detection
Time Series	15	Facebook Prophet	https://facebook.github.io/prophet/
Full Stack	16		https://github.com/kevindeasis/awesome-fullstack

Fire Evacuation

Upon hearing the second announcement on evacuation, staff and students are to follow the guidelines stated below:

DO:

- Evacuate immediately.
- Exit from the building using the nearest exit staircase – look out for this overhead **EXIT** sign to locate the exit staircases.
- Do not panic. Walk quickly and orderly down the staircase.
- Proceed to the primary assembly point - Carpark in front of I-Cube (I³) entrance.
- Your attendance will be taken by the fire warden.

DO NOT:

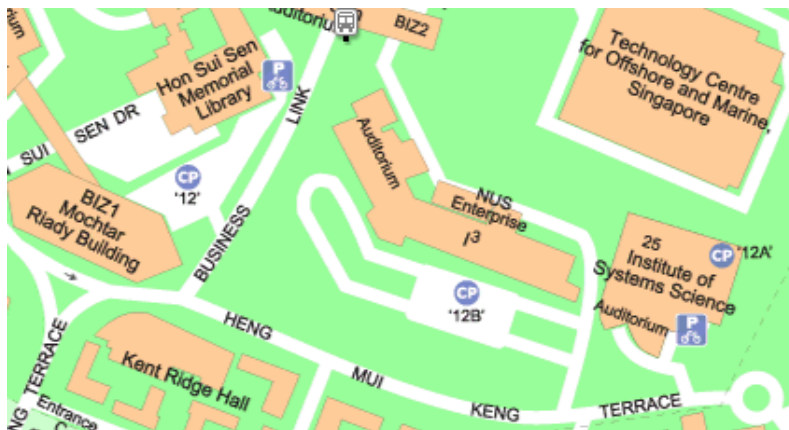
- Bring any belongings with you (bags, files, etc.).
- Use the lift as it will be de-activated upon the fire alarm trigger.
- Re-enter the building unless otherwise instructed by the Fire Safety Coordinator or SCDF Officer.

Fire Evacuation

Primary assembly point - Carpark in front of I-Cube (I3) entrance



In the event that the primary assembly point is not available, staff and students are to proceed immediately to the secondary assembly point - Carpark in front of Hon Sui Sen Memorial Library (NUS Business School).



END OF NOTES